APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/546,213	04/10/2000	Atsushi Watanabe	392.1682/JDH	3616

21171   7590   07/18/2003

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EXAMINER
HESSELTINE, RYAN J

ART UNIT	PAPER NUMBER
2623	

DATE MAILED: 07/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on _29 May 2003_ .

2a) ☒ This action is **FINAL.**   2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
   closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) _1-13_ is/are pending in the application.

   4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) _1-13_ is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

   Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☒ The proposed drawing correction filed on _07 April 2003_ is: a) ☐ approved b) ☒ disapproved by the Examiner.

   If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   a) ☒ All b) ☐ Some * c) ☐ None of:

   1. ☒ Certified copies of the priority documents have been received.

   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .

   3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage
      application from the International Bureau (PCT Rule 17.2(a)).

   * See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

   a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)   4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)   5) ☐ Notice of Informal Patent Application (PTO-152)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _12_ .   6) ☒ Other: *Translation of JP 07-319525* .

DETAILED ACTION

Drawings

1.   The proposed drawing correction filed on April 7, 2003 has been disapproved because it

is not in the form of a pen-and-ink sketch showing changes in red ink or with the changes

otherwise highlighted. In addition, it would be preferable if each axis of the coordinate axes in

Figures 1-3 were labeled for example as x-, y-, and z-axes. See MPEP § 608.02(v).

Double Patenting

2.   Applicant is advised that should claim 9 be found allowable, claim 12 will be objected to

under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application

are duplicates or else are so close in content that they both cover the same thing, despite a slight

difference in wording ("orientation" in claim 9 compared to "arrangement" in claim 12), it is

proper after allowing one claim to object to the other as being a substantial duplicate of the

allowed claim. See MPEP § 706.03(k).

Claim Objections

3.   Claims 1 and 2 are objected to because of the following informalities: the amendment

filed April 7, 2003 amended claims 1 and 2 such that after the word "and" in line 3 of both

claims appears an apparently erroneous right bracket ("]"). Appropriate correction is required.

Response to Arguments

4.   Applicant's arguments, see page 6, middle of the page, filed April 7, 2003, with respect

to a prior art label for Figures 11-13 have been fully considered and are persuasive. The

objection of Figures 11-13 has been withdrawn.

5.   Applicant's arguments, see page 7, second to last paragraph, filed April 7, 2003, with respect to the 35 USC 112, 2nd paragraph rejection of claims 1-3 have been fully considered and are persuasive. The rejection of claims 1-3 has been withdrawn.

6.   Applicant's amendment has required new grounds of rejection, which are set forth in the following Office action. Applicant's arguments with respect to claims 1 and 2 have been considered but are moot in view of the new ground(s) of rejection.

7.   Regarding applicant's arguments on page 8, second to last paragraph, applicant states that "Suzuki mentions the robot using a camera during construction, but it does not mention any detail of how that camera is used." The examiner respectfully disagrees. Suzuki discloses that 2-dimensional images of sample 10 are acquired by moving CCD camera pair 11a and 11b around the sample, or by rotating the sample, in order to obtain images from various directions to determine 3-dimensional positions of the vertices and edges of the sample. Suzuki further discloses a construction recognizing circuit that acquires part arrangement data including 3-dimensional positions and orientations of the parts included in the sample, which is stored in memory. Part detecting circuit (18) compares the layer outline data of each height obtained by position sorting circuit (17) with form data of each part stored in part-form memory (19), thereby specifying parts included in each layer (column 3, line 66-column 4, line 24).

Claim Rejections - 35 USC § 112

8.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9.   Claims 5-7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as

the invention. Claims 5-7 (depending from claim 2) recite the limitation "said image pickup

device" in lines 2 and/or 3. There is insufficient antecedent basis for this limitation in the claims.

It appears that applicant intended to change line 12 of claim 2 from "an image pickup means" to

"an image pickup device" as in amended claim 1.

Claim Rejections - 35 USC § 103

10.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

11.   Claims 1-6 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki

(USPN 4,835,450, reference of record) in view of Werth et al. (USPN 4,504,970, reference of

record), hereafter Werth.

12.   Regarding claims 1 and 8, Suzuki discloses a teaching model generating method and

device for image processing, in which a subject object has the same or substantially similar shape

as that of a reference object (column 3, line 66 to column 4, line 9), and the device comprising:

an image processing system with which current three-dimensional position and/or posture of the

subject object is recognized (determined) based on a plurality of predetermined teaching models

of the reference object (column 4, line 10-24); and an image-capture system, in advance of the

recognizing (determining), generating and storing the plurality of teaching models on the basis of

respective image data produced by taking images of said reference object from a plurality of

directions (column 4, line 25-39), wherein one of the reference object and an image pickup

device is fixed to a movable part of a robot or is grasped with a hand of the robot (either moving

the pair of CCD cameras 11a and 11b around fixed sample 10, or rotating sample 10 in front of

the fixed cameras), and said robot is operated for positioning to a plurality of different image

pickup positions and directions (column 3, line 66 to column 4, line 9), so that the image data

respectively obtained at each of said different image pickup positions is stored as a teaching

model (column 4, line 32-39).

13.   Suzuki does not explicitly disclose carrying out pattern matching processing of an image

of the subject based on the plurality of predetermined teaching models of the reference object.

Werth discloses a training controller for a pattern processing system applicable to a wide range

of different pattern processing requirements including visual image recognition (column 3, line

37-44). Werth discloses that an operator trains the system to recognize inspected parts by

assigning a training code to a correctly constructed part (teaching model) such as a printed circuit

board in its registered position (column 5, line 26-column 6, line 6). It would have been obvious

to one of ordinary skill in the art at the time the invention was made to carry out pattern

matching processing of the subject image as taught by Werth in order to provide improved

pattern recognition with a dramatic reduction in data by identifying image input patterns based

upon address loops to associate a desired response with an image input, thereby providing a

much faster response to complex input images (column 15, line 35-43).

14.   Regarding claim 2, Suzuki discloses a teaching model generating device for image

processing, in which a subject object has same or substantially similar shape as that of a

reference object, and the device comprising: an image processing system with which a current

three-dimensional position and/or posture of the subject object is recognized by carrying out

pattern matching processing of an image of the subject based on a plurality of pre-determined

teaching models of the reference object; and an image capture system, in advance of the recognizing, generating and storing the plurality of teaching models on the basis of respective image data produced by taking images of said reference object from a plurality of directions, wherein a robot is operated for positioning to a plurality of different relative image pickup positions and directions, so that the image data respectively obtained at each of said different image pickup positions is stored as a teaching model (see discussion of claim 1 above).

15.   Suzuki does not, however, disclose that the reference object is fixed to a movable part of a first robot or is grasped with a hand of the first robot, and an image pickup means is fixed to a movable part of a second robot or is grasped with a hand of the second robot. Werth discloses a training controller for pattern processing system wherein it is suggested that an application could utilize two robot arms, one which holds a camera which visually guides it to observe a precise assembly point and a second which brings a tool or assembly within the visual field of the camera where it is visually guided through an operation (column 5, line 12-17). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize two robot arms, one to hold a camera and one to hold a tool or assembly as taught by Werth in order to provide more degrees of freedom allowing more views of the workpiece from different directions and to provide proper alignment for mating parts in automated assembly operations or move a tool to a specific point on the part (column 5, line 6-11).

16.   Regarding claim 3, Suzuki discloses that said teaching model is a part of the image data of the reference object (column 4, line 32-39).

17.   Regarding claim 4, Suzuki discloses that said teaching model is composed of data obtained by performing image processing (3-D position detecting circuit 16) on the image data of the reference object (column 4, line 5-9).

18.   Regarding claim 5, Suzuki discloses that said teaching model is generated for every direction in which said image pickup device (means) took the image of said reference object (column 4, line 2-9) and said teaching model is stored in association with the information on the direction (column 4, line 32-39).

19.   Regarding claim 6, Suzuki discloses that said image pickup device (means) is a camera (column 3, line 30-34).

20.   Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki in view of Werth as applied to claim 2 above, and further in view of Ninomiya et al. (USPN 4,611,292, reference of record), hereafter Ninomiya.

21.   Suzuki does not disclose that said image pickup means (device) is a three-dimensional visual sensor whose image pickup means measures the distance between the image pickup means and a plurality of points on the object. Ninomiya discloses a robot vision system including a three-dimensional visual sensor whose image pickup means measures the distance between the image pickup means and a plurality of points on the object (column 4, line 28-49). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a three-dimensional visual sensor as taught by Ninomiya in order to determine the position and posture of an object without operation or accuracy being effected by contrast, color, or surface condition of the object (column 10, line 35-39).

22.   Claims 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki in

view of Werth as applied to claims 1 and 2 above and further in view of Iida et al. (JP 07-

319525, reference of record, English translation included herewith), hereafter Iida.

23.   Regarding claims 9 and 12, Suzuki discloses a method of automatic orientation

recognition, comprising: generating and storing a set of images of different relative orientations

(arrangements) of a subject, the images having been captured by a plurality of robotic operations

corresponding to the different relative orientations (arrangements) of the subject, and associating

with each image information indicating its respective relative orientation (arrangement) of the

subject (column 3, line 66-column 4, line 24); with a known current orientation (arrangement) of

a robot, capturing a current image of a workpiece, where the workpiece has a shape substantially

similar to the shape of the subject (column 4, line 49-column 5, line 11); Werth discloses using

pattern matching to match one of the stored images with the current image (column 5, line 26-

column 6, line 6; see above discussion of claims 1 and 2); and Suzuki discloses determining the

orientation (current arrangement) of the workpiece relative to the robot based on the relative

orientation (arrangement) information associated with the matched stored image (column 4, line

25-39), and also based on the known current orientation of the robot (column 3, line 50-62).

24.   Suzuki discloses that the positions where the robot grips the parts from the conveyor are

automatically detected using cameras 11a and 11b (column 4, line 49-68), but does not explicitly

disclose that the captured image includes a workpiece having an unknown orientation relative to

the robot. Iida discloses a high-speed picking device for piled parts wherein an image of piled

workpieces is captured in order to recognize the contour or border of a workpiece (W) in the pile

using collation with two or more stored models including information on two or more robot

hands which grasp a specific part (page 2, paragraph 9-12). It would have been obvious to one

of ordinary skill in the art at the time the invention was made to recognize a workpiece having an

unknown orientation relative to the robot as taught by Iida in order to avoid having to pre-orient

all parts before the robot can pick them up for assembly, inspection, or the like (page 1,

paragraph 3-4).

25.   Regarding claim 10, Suzuki discloses automatically maneuvering the robot to the

workpiece based at least on the determined orientation of the workpiece relative to the robot

(column 4, line 49-68).

26.   Regarding claim 11, Iida discloses that the generating and storing is performed for a

plurality of differently shaped subjects (page 4, paragraph 32), wherein the current image

includes a plurality of differently shaped (one of two or more specific) workpieces, and wherein

the pattern matching (collating) further comprises identifying workpieces from among the

plurality of differently shaped workpieces (page 2, paragraph 10) using the images and

orientation (posture) information of the plurality of differently shaped subjects (page 2,

paragraph 12-15).

27.   Regarding claim 13, Suzuki discloses a method comprising: robotically taking images of

a subject with different subject-camera arrangements, and associating with each image

information indicating its subject-camera arrangement (see above discussion of claims 1, 2, 8, 9,

and 12). Iida discloses taking a current image of a workpiece shaped like the subject; and then

determining a current workpiece-camera arrangement (posture) by matching (collating) one of

the images (models) with the current image, and using predetermined subject-camera

arrangement information of the matched image to determine the arrangement of the workpiece

relative to the camera (see above discussion of claims 9 and 12).

Conclusion

28.   The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure. USPN 4,876,728 to Roth discloses a vision system for distinguishing touching parts.

USPN 4,845,765 to Juvin et al. discloses a process for the automatic recognition of objects liable

to overlap. USPN 4,985,846 to Fallon discloses an acoustical/optical bin picking system. USPN

6,328,523 to Watanabe et al. (common inventor, commonly owned) discloses an apparatus for

picking up articles using a vision-controlled robot. USPN 3,804,270 to Michaud et al. discloses

a bulk storage and automatic presenter system with image producing means.

29.   Applicant's amendment necessitated the new ground(s) of rejection presented in this

Office action. Accordingly, THIS ACTION IS MADE FINAL. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the date of this

final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan J Hesseltine whose telephone number is 703-306-4069. The examiner can normally be reached on Monday - Friday, 8 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on 703-308-6604. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-0377.

rjh
July 8, 2003

PRIMARY EXAMINER